

We thank the reviewer for this important clarification and fully agree that the classical assumptions underlying Monin–Obukhov similarity theory (MOST), in particular horizontal homogeneity of the surface layer, are not strictly fulfilled at the horizontal scale of individual soil patches (order of decimeters) represented in our model.

In reality, atmospheric turbulence above such a heterogeneous surface integrates surface properties over larger spatial scales, and flux–gradient relationships cannot be meaningfully defined for individual patches. Consequently, MOST cannot be interpreted here as a physically valid description of patch-scale turbulence.

In DynSoM, MOST is therefore not applied as a local turbulence theory at the patch scale, but rather as a pragmatic closure to parameterize surface–atmosphere exchange using a shared atmospheric reference state. All soil patches interact with the same atmospheric conditions (temperature, humidity, wind speed at the reference height), and differences in turbulent fluxes arise solely from differences in surface temperature and moisture states. The calculated patch-scale fluxes should thus be interpreted as diagnostic contributions to the area-averaged surface flux rather than as independent, physically local turbulent fluxes.

This modeling choice is consistent with common tile-based land surface modeling approaches, where subgrid surface heterogeneity is represented while atmospheric feedbacks at the scale of individual tiles are deliberately not resolved. Since the primary objective of this study is to investigate the role of subsurface heterogeneity on surface energy balance components, rather than to explicitly simulate atmospheric boundary-layer processes, we consider this approach adequate for the purpose of the present study.

To avoid misunderstanding, we have revised the model description (sec. 2.1.2.) to explicitly state the limitations of MOST applicability at the patch scale and to clarify the interpretation of the resulting surface fluxes.

To follow our concept, the reader/reviewer may follow our code: DynSoM-2D's core code can be found in `HSM2d_v01_main.m`, which is run for each time step. Within `HSM2d_v01_main.m` `HSM_energy_flux.m` is called to calculate surface fluxes. `HSM_energy_flux.m` calls the `hybrid_root.m` module, which explicitly checks for Monin-Obukhov length, and calls `most.m`, where MOST is ultimately applied. All these simulation steps are done without any explicit lateral extension/2D usage. After successfully calculating surface fluxes (in 1D), 2D mode is applied by calling `HSM_soiltemp_lateral.m`.